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Research Article

Taxonomic corrections, new records, and life history information on the jumping tree bugs (Hemiptera, Miridae, Isometopinae) of Korea

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Abstract

The identities of two species of Korean Isometopinae (Hemiptera: Miridae) are clarified based on examination of their type material. The following new synonyms are proposed: *Isometopus amurensis* Kerzhner, 1988 = *Isometopus jejuensis* Kim & Jung, 2016, **syn. nov.** and *Myiomma ussuriense* Ostapenko, 2001 = *Myiomma koreanum* Oh & Lee, 2025, **syn. nov.** *Isometopus citri* Ren, 1987 is reported from Korea for the first time. Life histories of *I. amurensis* Kerzhner, *I. japonicus* Hasegawa, 1946, and *I. rugiceps* Kerzhner, 1988 are documented based on Korean individuals.

Key words: Biodiversity, distributions, East Asia, plant bugs, synonymy

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Introduction

A number of taxonomic and faunistic studies on jumping tree bugs (Hemiptera: Miridae: Isometopinae) of Korea have been conducted, despite the relatively recent discovery of this group from this region (Jung et al. 2015; Kim and Jung 2016; Ahn et al. 2018; Oh and Lee 2019; Oh et al. 2025). To date, four *Isometopus* Fieber, 1860 and one *Myiomma* Puton, 1872 species have been recognized in Korea. Examinations of photographs of the type material housed in the Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia, revealed that taxonomic corrections are needed for the recently described species from Korea. In addition, we herein update ecological and distributional data for the Korean jumping tree bug species.

Materials and methods

Specimen collection

Field surveys were mainly conducted from June 2023 to July 2024. Most specimens were hand-collected by visual inspections of the tree bark with an aspirator. Final-instar nymphs were collected and reared with the plant

bark of the respective collection site, mainly following the methodology of Tsunoda et al. (2020) by providing fermented milk beverage and brine shrimp eggs, supplemented with dead insects such as bark lice. Additional specimens were collected on light traps.

Morphological observation

Live specimens were photographed using Nikon D5600 or Nikon Z6ii equipped with Nikon AF-S VR Micro Nikkor ED 105 mm f/2.8G lens. The morphological terminology follows Yasunaga et al. (2017). For the type labels, the label data are cited verbatim, where individual lines are divided by '\'. Images of the type specimens of *Isometopus amurensis* Kerzhner, 1988 and *Myiomma ussuriense* Ostapenko, 2001 from Zoological Institute, Saint Petersburg, Russia were either retrieved from Konstantinov and Neimorovets (2025) or directly from the institution.

Ecological data

Data on the distribution and collection information for East Asian *Isometopus* species were compiled from Kerzhner (1988a, 1988b), Yasunaga (2001, 2005), Qi (2005), Kim and Jung (2016), Yasunaga et al. (2017), Urayama et al. (2019), and Tsunoda et al. (2020). The scientific names of the vascular plants were updated following Kew Plants of the World Online database (POWO 2025).

Molecular data and phylogenetic analysis

Genomic DNA was extracted using a DNeasy Blood and Tissue kit (Qiagen, Germany), following the manufacturer's protocol. Both the nymphs and the adults were immersed in the lysis buffer with proteinase K solution overnight at 56 °C. After incubation, the specimens were removed, cleaned, and stored in 99% ethanol at SCNU for future reference. The mitochondrial cytochrome c oxidase subunit I (COI) was amplified using the polymerase chain reaction (PCR) with the primers LCO1490F (5-GGTCAACAAATCATAAAGATATTGG-3) and HCO2198R (5-GGTCAACAAATCATAAAGATATTGG-3) following the thermal cycling condition for Miridae following Oh et al. (2023) of initial denaturation at 95 °C for 2 min, followed by 38 cycles of denaturation at 95 °C for 30 s, annelation at 45–55 °C for 30 s, extension at 72 °C for 1 min, and final extension at 72 °C for 10 min. The amplicons were purified and sequenced in Bionics Co. (Seoul, Korea). Consensus sequences were generated in Geneious Prime software, and multiple sequence alignment was performed in MAFFT online (Katoh et al. 2017). Final sequence assessment was performed in MEGA X (Kumar et al. 2018). A total of 20 sequences were used, of which 14 were newly sequenced and six were obtained from GenBank (Table 1). Phylogenetic analysis was conducted in raxmlGUI 2.0 (Edler et al. 2020) using ML+rapid bootstrap option with 1000 reps. The resulting tree was visualized in FigTree v. 1.4.4 (Rambaut 2018). The genetic distances of the COI sequences were calculated using *p*-distance option in MEGA X.

Table 1. Details of selected COI sequences used for the phylogenetic analysis.

Species	GenBank accession number	Locality	Reference
Sophianus lamellatus Ren & Yang, 1988	MZ408091.1	Cambodia	Oh et al. (2023)
Myiomma ussuriense Ostapenko, 2001	PX056004	Suwon, Korea	This work
Isometopus amurensis Kerzhner, 1988	KY367033.1	Ansan, Korea	Kim and Jung (2018)
Isometopus amurensis Kerzhner, 1988	MZ408037.1	Anyang, Korea	Oh et al. (2023)
Isometopus amurensis Kerzhner, 1988	PX055995	Incheon, Korea	This work
Isometopus amurensis Kerzhner, 1988	PX055991	Anyang, Korea	This work
Isometopus amurensis Kerzhner, 1988	PX055994	Suwon, Korea	This work
Isometopus amurensis Kerzhner, 1988	PX055993	Ilsan, Goyang, Korea	This work
Isometopus amurensis Kerzhner, 1988	PX055992	Gwacheon, Korea	This work
Isometopus jejuensis Kim & Jung, 2016	KY367037.1	Jeju, Korea	Kim and Jung (2018)
Isometopus japonicus Hasegawa, 1946	KY367035.1	Jangseong, Korea	Kim and Jung (2018)
Isometopus japonicus Hasegawa, 1946	PX055997	Pocheon, Korea	This work
Isometopus japonicus Hasegawa, 1946	PX055998	Seocho, Seoul, Korea	This work
Isometopus japonicus Hasegawa, 1946	PX055999	Gwacheon, Korea	This work
Isometopus japonicus Hasegawa, 1946	PX056000	Ilsan, Goyang, Korea	This work
Isometopus japonicus Hasegawa, 1946	PX055996	Siheung, Korea	This work
Isometopus rugiceps Kerzhner, 1988	PX056001	Anyang, Korea	This work
Isometopus rugiceps Kerzhner, 1988	PX056002	Gwacheon, Korea	This work
Isometopus rugiceps Kerzhner, 1988	PX056003	Sancheong, Korea	This work
Isometopus rugiceps Kerzhner, 1988	MZ408038.1	Inje, Korea	Oh et al. (2023)

Depositories of specimens

The specimens examined or mentioned in this study are deposited in the following institutions:

CNU Laboratory of Systematic Entomology, Chungnam National University, Daejeon, Korea;
NIAES National Institute for Agro-Environmental Sciences, Tsukuba, Japan;
NIBR National Institute of Biological Resources, Incheon, Korea;
NKUM Institute of Entomology, Nankai University, Tianjin, China;
SCNU Department of Forest Resources, Sunchon National University, Suncheon, Korea;
SNU Insect Biosystematics Laboratory, Seoul National University, Seoul, Korea;
UMMZ Museum of Zoology, University of Michigan, Ann Arbor, USA;
ZISP Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

Results

Taxonomy

Family Miridae Hahn, 1833
Subfamily Isometopinae Fieber, 1860
Tribe Isometopini Fieber, 1860
Genus *Isometopus* Fieber, 1860

Isometopus amurensis Kerzhner, 1988

Figs 1A–J, 2A–H, 3A–F, 6A–G

Isometopus amurensis Kerzhner, 1988a: 789. Lectotype (as holotype, see Kerzhner 1988b: 4): ♂, Russia: Vityaz', 15 km south of Sukhanovka; ZISP.

Isometopus jejuensis Kim & Jung, 2016: 138. Holotype: ♀, Korea: Jungmun-dong, Jeju Island; CNU. syn. nov.

Isometopus amurensis: Kerzhner 1988b: 4 (redescription); Kerzhner and Josifov 1999: 3 (catalogue, distribution); Schuh 2002–2013 (web catalogue); Jung et al. 2015: 598 (distribution, Korea); Ahn et al. 2018: 381 (diagnosis, photo); KSAE and ESK 2021: 155 (list); Taszakowski et al. 2023: 185 (catalogue).

Isometopus jejuensis: KSAE and ESK 2021: 155 (list); Taszakowski et al. 2023: 186 (catalogue).

Type material examined. ***Isometopus amurensis*. *Lectotype*:** ♂, "[PRIMORSKY KRAI, Khasan \ District, Vityaz' \ 15 km S of Sukhanovka \ Kerzhner 21.viii.1982]" [printed], back of the label: "[shaking off branches of Quercus dentata]" [handwritten] "*Holotypus* Isometopus \ amurensis sp. n. \ Kerzhner det. 986" [printed + handwritten] "*Lectotypus* \ Isometopus \ amurensis \ design. Kerzh. 1987" [printed + handwritten] also with ZISP catalogue number: INS_HEM_0000123. ***Paralectotype*:** ♀, "[PRIMORSKY KRAI, Khasan \ District, Vityaz' \ 15 km S of Sukhanovka \ Kerzhner 20.viii.1982]" [printed], "*Paratypus* Isometo- \ pus amurensis \ Kerzh." [printed + handwritten] "*Paralectotypus* \ Isometopus \ amurensis \ design. Kerzh. 1987" [printed + handwritten], both deposited in ZISP, photographs examined. ***Isometopus jejuensis*. *Holotype*:** ♀, "Jungmun-dong, Seogwipo-si, \ Jeju-do (Is.), Korea, 5.IX.2015, \ on *Neolitsea sericea*, J.G. Kim" [printed] "Isometopus jejuensis \ Kim et Jung, 2016" [printed] "HOLOTYPE" [printed], deposited in CNU.

Additional material examined. South Korea – **Gyeonggi-do.** • 1 ♂; 12, Byeoryang-ro, Gwacheon-si; 37°25.26'N, 126°59.42'E; on light; 15.viii.2019; W. Kim leg. (SNU) • 1 ♀; Seoul National University Gwanak Arboretum, Anyang-si; 05.viii.2015; M. Oh leg. (SNU) • 1 ♂, 2 nymphs (5th); Jungang-dong, Gwacheon-si; 37°25.52'N, 126°59.27'E; 17.vi.2023; W. Kim leg. (UMMZ); • 4 ♂♂, 4 ♀♀, 2 nymphs (5th); same locality; 21.vi.2023; W. Kim leg. (SNU) • 1 nymph; Manan-gu, Anyang-si; 37°25.96'N, 126°54.92'E; 21.vi.2024; W. Kim leg. (UMMZ) • 2 nymphs; Ilsan lake park, Goyang-si; 37°39.17'N, 126°45.85'E; 20.vi.2024; W. Kim leg. (SCNU) • 5 nymphs (four 5th); Gwanggyo Park, Jangan-gu, Suwon-si; 37°18.02'N, 127°01.80'E; 22.vi.2024; W. Kim and M. Choi leg. (SCNU) • 1 ♂, 2 ♀♀, 4 nymphs (two 5th); same locality; 26.vi.2024; W. Kim and M. Oh leg. (SNU) • 5 ♂♂, 4 ♀♀, 1 nymph; Jungang-dong, Gwacheon-si; 37°25.52'N, 126°59.27'E; 26.vi.2024; W. Kim leg. (SNU, SCNU) • 1 ♂, 2 ♀♀, 2 nymph (one 5th); same locality and collector; 28.vi.2024 (UMMZ). – **Incheon.** • 1 ♂, 2 nymphs; Sorae Wetlands Ecology Park, Nonhyeon-dong, Namdong-gu; 37°24.55'N, 126°44.72'E; 14.vi.2023; W. Kim leg. (SCNU). – **Jeollanam-do.** • 1 ♀, 2 nymphs (5th); Yongdang-dong, Suncheon-si; 34°58.30'N, 127°29.29'E; 7.vii.2024; W. Kim leg. (SCNU). – **Jeju-do.** • 2 nymphs; Hoecheon-dong, Jeju-si; 33°26.96'N, 126°38.36'E; 5.vii.2025; W. Kim leg. (UMMZ).

Diagnosis. Sexually dimorphic (Figs 1, 2, 6). Easily distinguished from congeners in East Asia by the light brown frons and distinct punctation pattern (Fig. 2E–H); hyaline hemelytra, and apically white scutellum in males; yellowish-white hemelytra

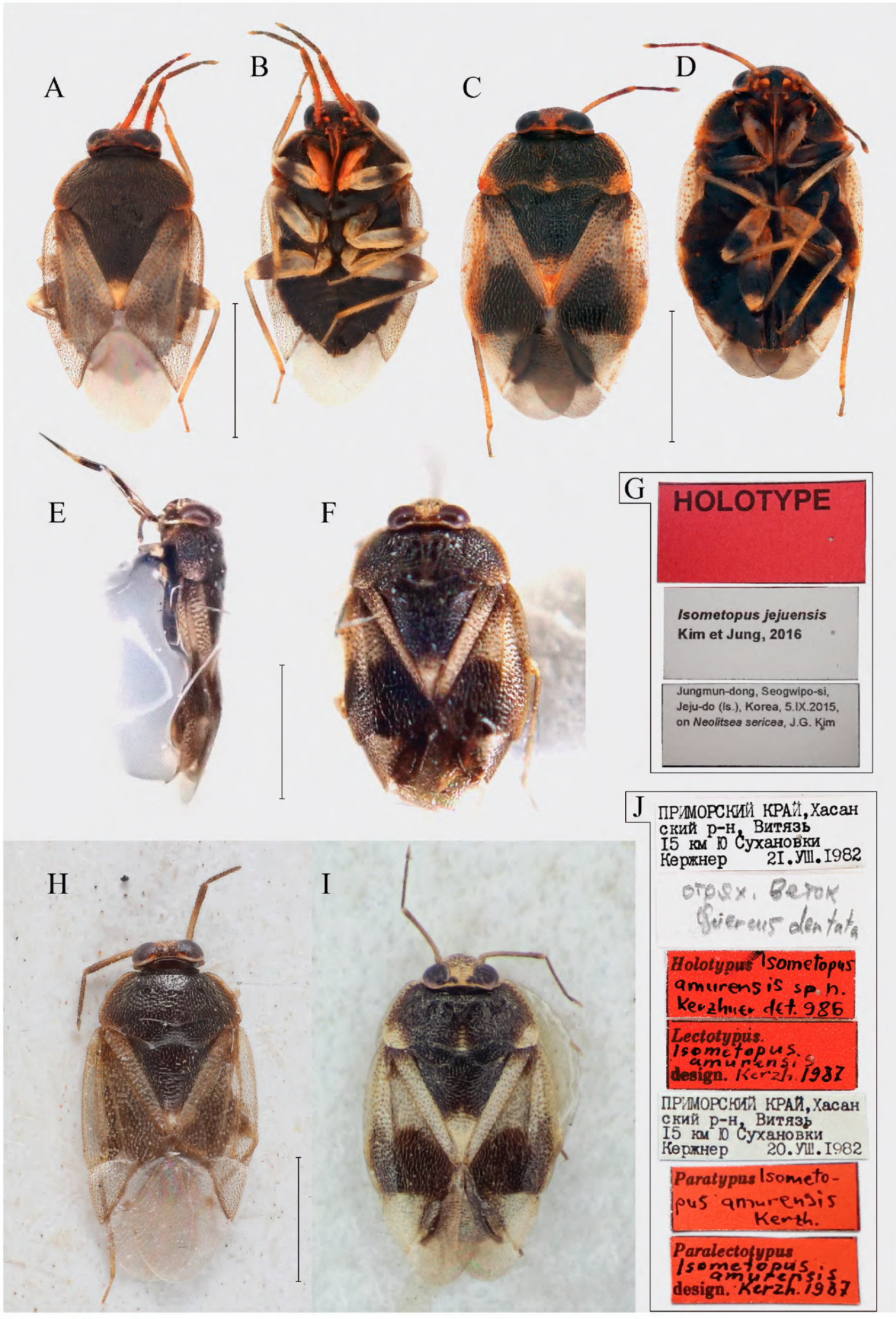

Figure 1. A–D. *Isometopus amurensis* Kerzhner, 1988 **E–G.** *I. jejuensis* Kim & Jung, 2016. **A.** Non-type male from Gwacheon, Korea, dorsal view; **B.** Same, ventral view; **C.** Non-type female, same locality, dorsal view; **D.** Same, ventral view; **E.** Holotype female, lateral view; **F.** Same, dorsal view; **G.** Label; **H.** Lectotype male of *I. amurensis*, dorsal view; **I.** Paralectotype female of *I. amurensis*, from Vityaz', Primorsky Krai, Russia, dorsal view; **J.** Label (lectotype, paralectotype). Scale bars: 1.0 mm. © ZISP (H–J).

with a dark band on the posterior half of corium in females; nymphs as in Fig. 6E–G. As suggested by Kerzhner (1988b), this species is externally similar to *I. tianjinus* Hsiao, 1964, but *I. amurensis* can be distinguished by the tip of the left paramere not swollen in male, and the black scutellum except for the white apical 1/3–1/4 in females (Hsiao 1964; Kerzhner 1988b; Liu et al. 2022). However, since the known descriptions and figures for *I. tianjinus* are brief, future works are needed to clearly elucidate the diagnostic characters between *I. tianjinus* and *I. amurensis*.

Distribution. Russia (Far East: Amur Oblast, Primorsky Krai) (Kerzhner 1988b), South Korea (Gyeonggi-do, Gangwon-do, Jeollabuk-do, Jeollanam-do, Jeju-do) (Jung et al. 2015; Kim and Jung 2016; Ahn et al. 2018).

Species status of *Isometopus jejuensis* Kim & Jung, 2016

Isometopus amurensis Kerzhner, 1988 was described based on a male holotype and an additional male and three female paratypes from the Russian Far East (Amur Oblast, Primorsky Krai). The original description states that *I. amurensis* resembles *I. tianjinus* Hsiao, 1964 from northern China (Liu et al. 2022) and *I. kaznakovi* Kiritshenko, 1939 from the Caucasus (Kerzhner and Josifov 1999).

Isometopus jejuensis Kim & Jung, 2016 was described based on a female holotype and an additional 11 female paratypes collected from a single locality in Jungmun-dong, Jeju Island, South Korea. The authors discussed that their new species resembles *I. amurensis* but can be distinguished by 1) the dark brown antennal segment II, 2) the unique shape of female sclerotized rings, and 3) different host plants. They also compared the new species with *I. nigrosignatus* Ren, 1987 (from Yunnan province in China and Taiwan, cf. Lin and Yang 2004; Liu et al. 2022) and *I. mirificus* Mulsant & Rey, 1879 (from various parts of Europe, cf. Wagner and Weber 1964; Kerzhner and Josifov 1999) and noted distinctions in the color pattern of dorsum. However, Kim and Jung (2016)'s mention of *I. mirificus* from Ishigaki Island, Japan, is likely an oversight of literature: the species from Ishigaki was tentatively reported as *I. mahal* (Distant, 1911) by Yasunaga and Hayashi (2002) and later recognized as a new species, *I. ishigaki* Yasunaga, 2012, which is known only from the Yaeyama Island group of the Ryukyus that inhabits the bark of *Fraxinus griffithii* C. B. Clarke (Oleaceae) (Yasunaga 2005; Yasunaga et al. 2012, 2017). We also note that *I. mahal* was synonymized with *I. mirificus* by Carvalho (1951), but later resurrected by Akingbohugbe (1996). Its current distribution is now restricted to Karnataka and West Bengal states in India (Yeshwanth et al. 2021). Therefore, the accurate name for the species in Ishigaki Island is *I. ishigaki*, instead of *I. mirificus*.

Both *I. nigrosignatus* and *I. ishigaki* bear superficial similarity with *I. jejuensis* in terms of the 'black and white' dorsal coloration; they clearly differ from *I. jejuensis* by the general body shape and color pattern of the frons. Rather, *I. nigrosignatus* and *I. ishigaki* are known to be related to *I. mahal* from India (Yasunaga 2005; Yeshwanth et al. 2021), and are also similar to *I. hainanus* Hsiao, 1964 from Hainan Island, China (see Liu et al. 2022: 432–433, pl. xvii).

Many isometopines exhibit sexual dimorphism regarding coloration and structure (Slater and Schuh 1969; Yasunaga et al. 2017), and the lack of a male description of *I. jejuensis* makes it challenging to thoroughly compare its identity with congeners. Therefore, on the identity of *I. jejuensis*, we restrict the morphological discussion to only females.

Morphology

Kerzhner (1988b) described the coloration of antennal segment II in females of *I. amurensis* as 'whitish in female, with pale brown apex'; this condition is confirmed in the paralectotype female (Fig. 1I). On the other hand, Jung et al. (2015) mention that *I. amurensis* has '[uniformly] yellowish brown' antennae. Kim and Jung (2016) described antennal segment II of *I. jejuensis* as 'dark brown except for pale apex'. However, the pale apex in Kim and Jung (2016) actually refers to the extreme apex where segment III meets segment II; therefore, we regard the coloration of segment II of *I. jejuensis* as being uniformly dark brown.

Our re-examinations of female *I. amurensis* specimens from the Russian Far East and Korea (Figs 2A, B, 6C, D) revealed that the color pattern of the antennae can vary between pale brown with darker apex to uniformly brownish. Figs 2A, B, 6C, D show a series of specimens with varying antennal color collected from a single tree in Gwacheon-si, Korea, strongly suggesting that the color of the antennae is subject to variation among individuals. There are also reported cases in the genus *Isometopus* of which the color of the antennae is variable. The male *Isometopus hananoi* Hasegawa, 1946 illustrated in the figure of Tsunoda et al. (2020: fig. 6) shows two types of color pattern for antennal segment II: uniformly pale brown or pale brown with darker apex. Therefore, the color difference of antennal segment II cannot serve as a decisive character for unequivocally distinguishing *I. jejuensis* from *I. amurensis*.

Kim and Jung (2016) provided a schematic drawing of the sclerotized rings of *I. jejuensis* and argued that the structure of the apex of each sclerotized ring is different from *I. amurensis* (Kim and Jung 2016: fig. 4A, C). Dissection of selected *I. amurensis* females from South Korea showed that the structure of the sclerotized ring is variable even between specimens collected from close proximity (Fig. 3A–F). All dissected individuals have elongate-oval, teardrop-shaped thin-rimmed sclerotized rings (Fig. 3A, C, E). The sclerotized rings of the individual from Suwon (Fig. 3E) are similar to the shape illustrated for *I. jejuensis* by Kim and Jung (2016: fig. 4A), whereas the individual from Gwacheon (Fig. 3A) corresponds to the shape illustrated for *I. amurensis* in Jung et al. (2015: fig. 1D) and Kim and Jung (2016: fig. 4C). Considering that the dissected individuals were found in geographically close regions, the subtle variance observed in the sclerotized ring suggests that these structures cannot be used as a diagnostic character in distinguishing *I. jejuensis* from *I. amurensis*.

Even though it was not mentioned as a diagnostic character differentiating *I. jejuensis* from *I. amurensis* by Kim and Jung (2016), the cuneal color pattern is different between the published descriptions of the two species. Kerzhner (1988b: 5, fig. 2) showed that the cuneus of *I. amurensis* is white, without any markings, which is confirmed with the actual condition found in the paralectotype (Fig. 1I). This coincides with the redescription of Jung et al. (2015: 599) of this species. In contrast, Kim and Jung (2016) described the cuneal coloration of *I. jejuensis* as being 'anterior part of cuneus pale brown, apical part of cuneus grayish'. The cuneal coloration in *I. amurensis* is variable even between specimens collected from the same locality (Fig. 2C, D), and the cuneal color pattern of *I. jejuensis* (Kim and Jung 2016: 138, 143: figs 1A, 6A) corresponds to the color of *I. amurensis* in Fig. 2C.

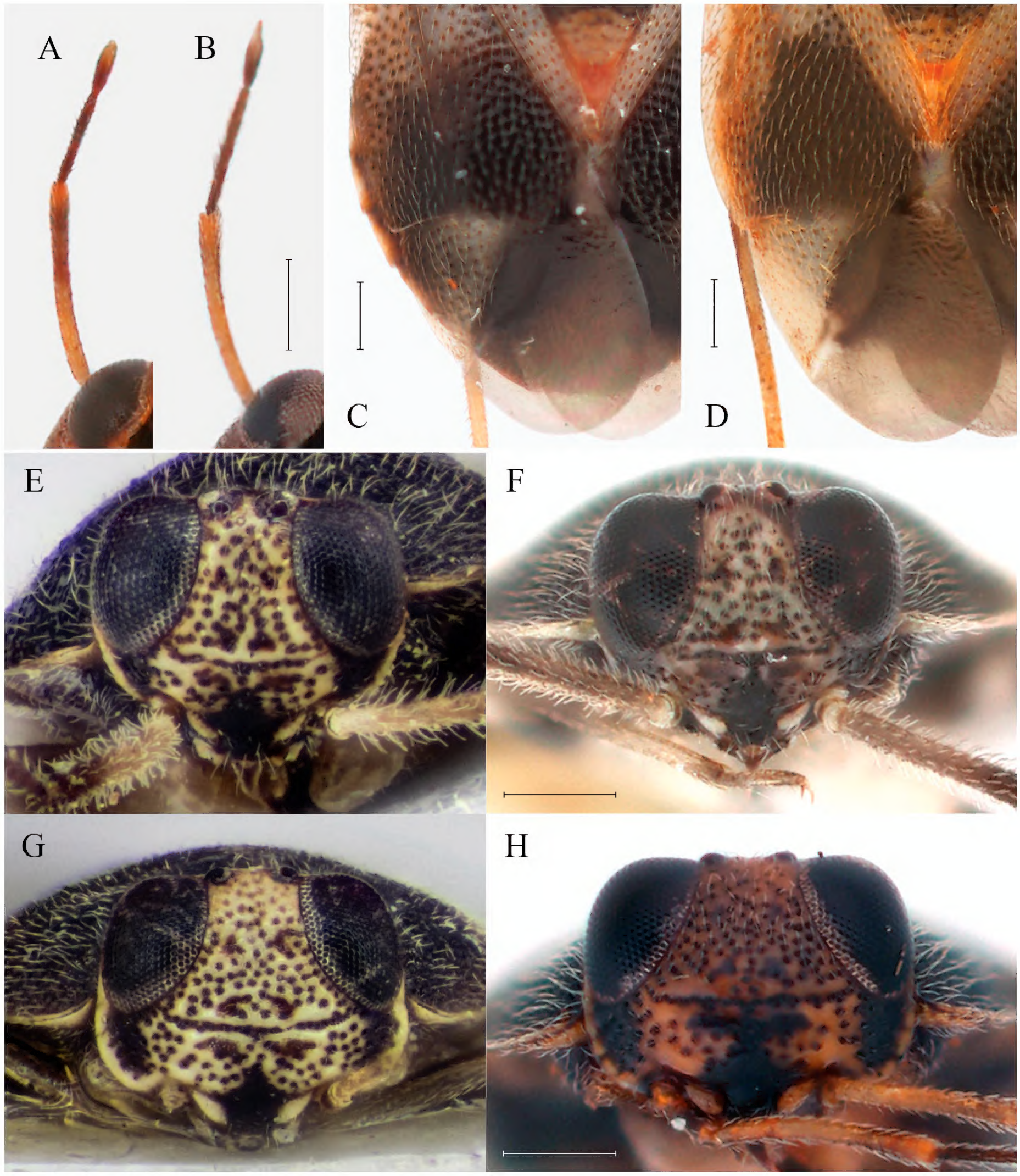

Figure 2. *Isometopus amurensis* Kerzhner, 1988. **A–D, F, H.** Non-type specimens from Korea. E, G: type specimens from Primorsky Krai, Russia. **A, B.** Antennae, female; **C, D.** Hemelytral coloration, female; **E.** Head in frontal view, lectotype male; **F.** Head in frontal view, male; **H.** Same, female; **G.** Same, paralectotype female. Scale bars: 0.2 mm. © ZISP (**E, G**).

Other diagnostic characters of *I. jejuensis* (e.g., coloration and punctation pattern of head, antennal proportion, vestiture of the dorsum, and general color pattern) commonly used in classifying *Isometopus* species (cf. Wagner and Weber 1964) are virtually identical to *I. amurensis*. Examination of the type specimens of *I. amurensis* and *I. jejuensis*, accompanied by the description and figure in Kim and Jung (2016: 138, 143: figs 1A, E, 6A) make it evident that it is conspecific with *I. amurensis*.

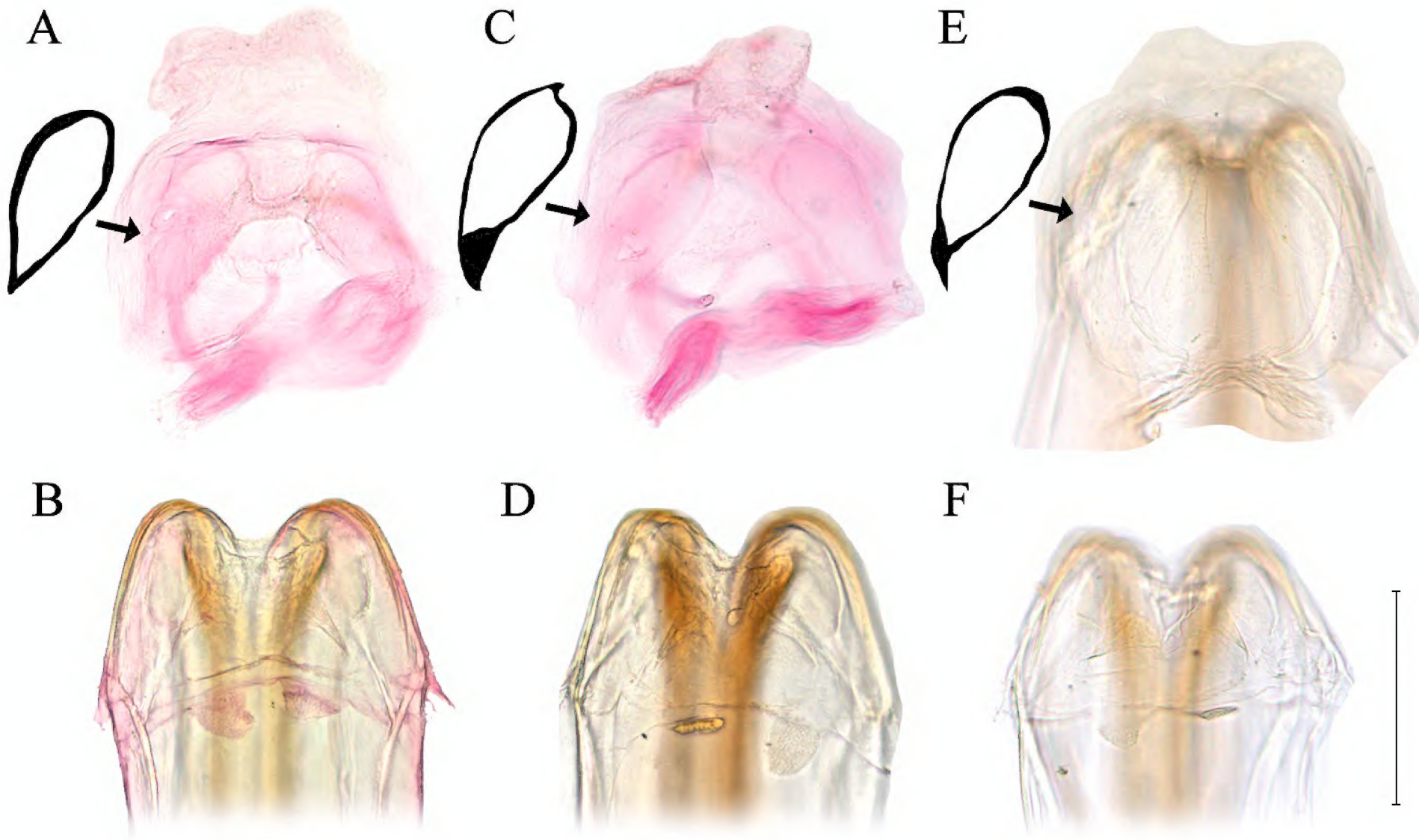

Figure 3. Female genital structure of *Isometopus amurensis* Kerzhner, 1988. **A, C, E**. Sclerotized ring; **B, D, F**. Posterior wall. Collection localities: **A–D**. Gwacheon-si, Korea (37.425414, 126.987958); **E, F**. Suwon-si, Korea (37.300349, 127.030048). Scale bar: 0.2 mm.

Molecular analysis

According to our maximum likelihood (ML) tree (Fig. 4), *I. jejuensis* sample (KY367033.1) from Jeju Island (33.43N, 126.62E) published by Kim and Jung (2018) is clearly nested within the clade of *I. amurensis* samples from various localities in South Korea, with a strong bootstrap support value (BS = 100).

Furthermore, the uncorrected pairwise sequence differences (*p*-distances) based on 511 bp mitochondrial COI sequences between *I. amurensis* and *I. jejuensis* were 1.76–2.73% (Table 2). Considering that in previous studies, the average intraspecific COI sequence distance for mirid species such as *Eurystylus coelestialium* (Kirkaldy, 1902) was reported as up to 2.8% (Kim and Jung 2018), we regard *I. jejuensis* (sample no. KY367037.1) genetically indistinct from other *I. amurensis* samples.

Bionomics

Kerzhner (1988b) reported *I. amurensis* from the bark of *Quercus dentata* Thunb. and *Q. mongolica* Fisch. ex Ledeb. (Fagaceae) in the Russian Far East and Jung et al. (2015) reported a single female on the bark of *Taxus cuspidata* Siebold & Zucc. (Taxaceae) in South Korea. Kim and Jung (2016), in describing *I. jejuensis*, reported it from the bark of *Neolitsea sericea* (Blume) Koidz. (Lauraceae). This broadleaf is indigenous to warm temperate and subtropical East Asia, which is sparsely distributed in Jeju-do and Ulleng-do islands and the southwestern coastline in Korea (Lee and Choi 2010). These different host associations prompted Kim and Jung (2016) to argue the distinctiveness of *I. jejuensis* from *I. amurensis*.

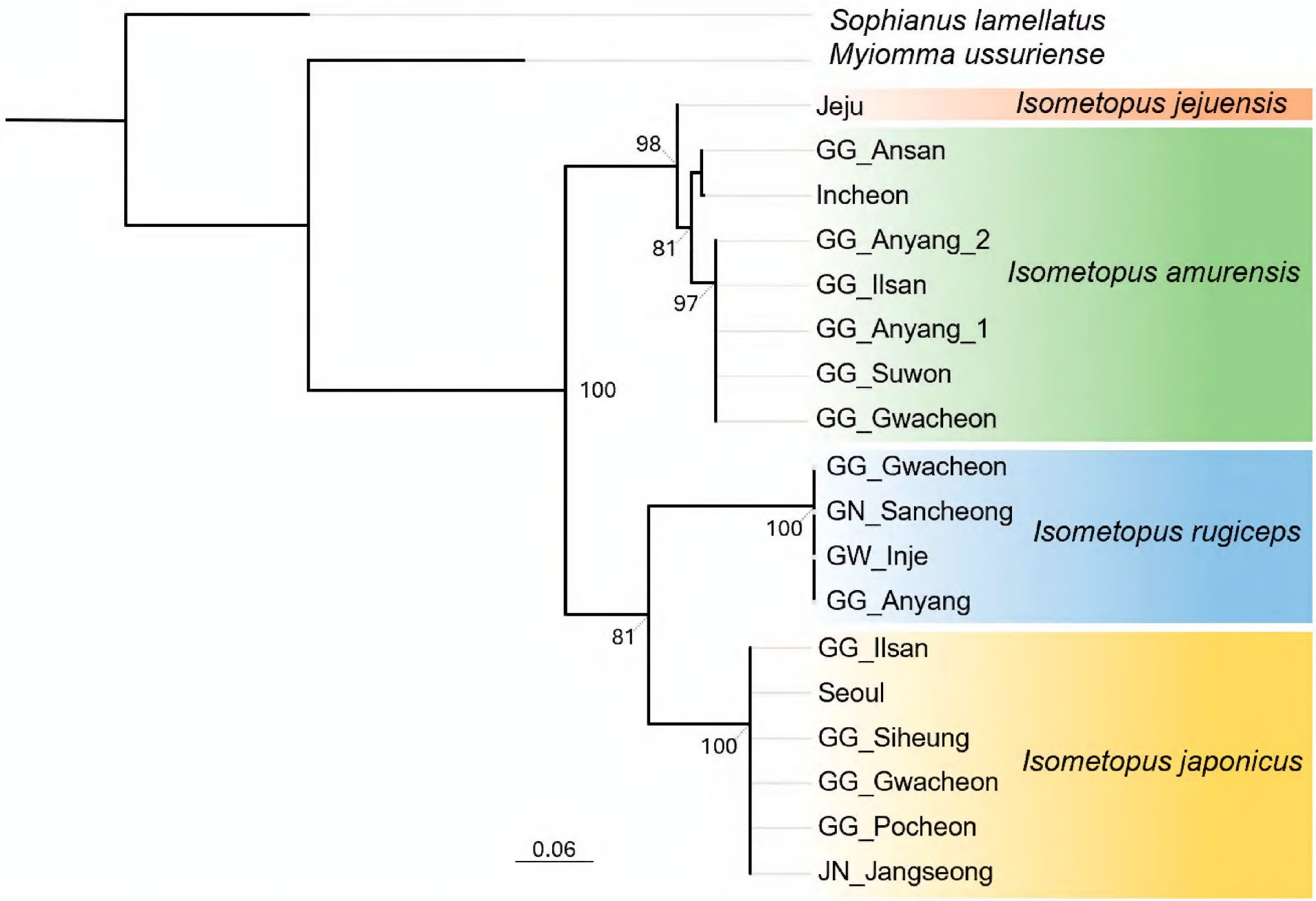

Figure 4. Maximum likelihood (ML) tree of selected *Isometopus* species based on COI sequences (511 bp).

Table 2. Uncorrected pairwise distances for *Isometopus* species (*I. amurensis*, *I. japonicus*, *I. jejuensis*, and *I. rugiceps*), based on 511 bp mitochondrial COI sequences. Intraspecific *p*-distances are in bold font.

	Species	*n*	1	2	3	4
1	*Isometopus amurensis*	7	**0–2.54**			
2	*Isometopus jejuensis*	1	1.76–2.73	–		
3	*Isometopus japonicus*	6	13.30–14.09	13.11	**0.00**	
4	*Isometopus rugiceps*	4	14.67–15.06	14.67	11.74	**0.00**

However, many isometopine species are believed not to be host plant specific (Yasunaga and Hayashi 2002; Namyatova and Cassis 2016), and our field observation and literature review for species occurring in East Asia (Table 3) support this viewpoint. The nymphs of *Isometopus* species are found on the bark of trunks and branches of various broadleaved trees, and occasional adults are confirmed on plants that likely represent opportunistic habitats (e.g., *I. japonicus* on *Picea* sp., Yasunaga 2005). East Asian species have been reported on 3–10 different plant families, and some were even confirmed on non-native plants (i.e., *I. amurensis*, *I. hananoi*, and *I. japonicus*, see Table 3). Since many isometopine species are known to be predaceous and presumed to prey on small arthropods (Wheeler and Henry 1978; Yasunaga 2005; Namyatova and Cassis 2016; Tsunoda et al. 2020), the plant association is presumed not to play a significant role in the lifecycle of this group.

Table 3. Collection substrate of East Asian *Isometopus* species. ! plant species with immatures confirmed; * plant species which are non-native within its distributional range, [1] *F. griffithii* in Nagasaki, Kyushu is an introduced population possibly from the Ryukyus (Yasunaga et al. 2017).

Species	Collection substrate (plant bark)	Family	References	Locality
Isometopus amurensis Kerzhner, 1988	*Betula pendula* subsp. *mandshurica* (Regel) Ashburner & McAll. !*	Betulaceae	This work	Korea
	Albizia julibrissin Durazz. !	Fabaceae	This work	Korea
	Styphnolobium japonicum (L.) Schott !*	Fabaceae	This work	Korea
	Quercus dentata Thunb.	Fagaceae	Kerzhner (1988b)	Russia (Far East)
	Quercus mongolica Fisch. ex Ledeb.	Fagaceae	Kerzhner (1988b)	Russia (Far East)
	Quercus palustris Münchh. !*	Fagaceae	This work	Korea
	Neolitsea sericea (Blume) Koidz.	Lauraceae	Kim and Jung (2016)	Korea (Jeju)
	Prunus × yedoensis Matsum. !*	Rosaceae	This work	Korea
	Salix sp. !	Salicaceae	This work	Korea
	Acer palmatum Thunb. !	Sapindaceae	This work	Korea
	Styrax japonicus Siebold & Zucc. !	Styracaceae	This work	Korea (Jeju)
	Taxus cuspidata Siebold & Zucc.	Taxaceae	Jung et al. (2015)	Korea
	Zelkova serrata (Thunb.) Makino !	Ulmaceae	This work	Korea
Isometopus beijingensis Ren & Yang, 1988	Unknown		Qi (2005)	China
Isometopus bipunctatus Lin, 2004	*Fraxinus griffithii* C.B.Clarke !	Oleaceae	Yasunaga et al. (2017)	Taiwan
Isometopus citri Ren, 1987	*Prunus × yedoensis* Matsum. *	Rosaceae	This work	Korea
	Citrus maxima (Burm.) Merr. *	Rutaceae	Qi (2005)	China
	Zelkova serrata (Thunb.) Makino	Ulmaceae	This work	Korea
Isometopus fasciatus Hsiao, 1964	Unknown		Qi (2005)	China
Isometopus hainanus Hsiao, 1964	Unknown		Qi (2005)	China
Isometopus hananoi Hasegawa, 1946	*Quercus* sp.	Fagaceae	Yasunaga et al. (2017)	Japan
	Fraxinus griffithii C.B.Clarke *	Oleaceae	Yasunaga et al. (2017)	Japan (Kyushu[1])
	Prunus sp.	Rosaceae	Yasunaga et al. (2017)	Japan
	Zelkova serrata (Thunb.) Makino !	Ulmaceae	Urayama et al. (2019) Tsunoda et al. (2020)	Japan
Isometopus hasegawai Miyamoto, 1965	*Pinus luchuensis* Mayr	Pinaceae	Yasunaga (2005)	Japan (Ryukyu)
Isometopus ishigaki Yasunaga, 2012	*Cinnamomum chekiangense* Nakai	Lauraceae	Yasunaga (2005)	Japan (Ryukyu)
	Fraxinus griffithii C.B.Clarke !	Oleaceae	Yasunaga (2005)	Japan (Ryukyu)
Isometopus japonicus Hasegawa, 1946	*Betula pendula* subsp. *mandshurica* (Regel) Ashburner & McAll.	Betulaceae	Yasunaga (2001)	Japan
	Robinia pseudoacacia L. !*	Fabaceae	This work	Korea
	Castanopsis cuspidata (Thunb.) Schottky	Fagaceae	Shishido et al. (2020)	Japan
	Quercus palustris Münchh. !*	Fagaceae	This work	Korea
	Picea sp.	Pinaceae	Yasunaga (2005)	Japan
	Prunus × yedoensis Matsum. !*	Rosaceae	This work	Korea
	Prunus sargentii Rehder	Rosaceae	Yasunaga (2001)	Japan
	Sorbus commixta Hedl.	Rosaceae	Yasunaga (2001)	Japan
	Acer palmatum Thunb. !	Sapindaceae	This work	Korea
	Taxus cuspidata Siebold & Zucc.	Taxaceae	Yasunaga (2001)	Japan
	Zelkova serrata (Thunb.) Makino !	Ulmaceae	Yasunaga (2001), Kim and Jung (2016), Urayama et al. (2019)	Japan, Korea
Isometopus lini Lin, 2004	Unknown		Yasunaga et al. (2017)	Taiwan
Isometopus marginatus Ren & Yang, 1988	Unknown		Qi (2005)	China
Isometopus nigrosignatus Ren, 1987	Unknown		Qi (2005)	China
Isometopus puberus Ren, 1991	Unknown		Qi (2005)	China
Isometopus renae Lin, 2004	Unknown		Yasunaga et al. (2017)	Taiwan
Isometopus rugiceps Kerzhner, 1988	*Albizia julibrissin* Durazz. !	Fabaceae	This work	Korea
	Robinia pseudoacacia L. !*	Fabaceae	This work	Korea
	Quercus dentata Thunb.	Fagaceae	Kerzhner (1988b)	Russia (Far East)
	Prunus (*Cerasus*) sp. !	Rosaceae	This work	Korea
	Zelkova serrata (Thunb.) Makino !	Ulmaceae	This work	Korea
Isometopus shaowuensis Ren, 1987	*Citrus* sp.	Rutaceae	Qi (2005)	China
Isometopus takaii Yasunaga, 2012	*Fraxinus griffithii* C.B.Clarke	Oleaceae	Yasunaga (2005)	Japan (Ryukyu)
Isometopus tianjinus Hsiao, 1964	*Styphnolobium japonicum* (L.) Schott	Fabaceae	Qi (2005)	China

Adults of *I. amurensis* were confirmed on the bark of 12 plant species in nine families (Table 3). Of these, immatures were confirmed from the bark of nine plant species in eight families. Among the confirmed breeding hosts, *Betula pendula* subsp. *mandshurica* (Regel) Ashburner & McAll. (Betulaceae) and *Quercus palustris* Münchh. (Fagaceae) are non-native plants in South Korea which have been imported for urban landscaping purpose (Korea National Arboretum 2010; Kim and Kim 2018). The wide and flexible habitat preference of *I. amurensis* shows that the different host plants cannot be used to distinguish the *N. sericea*-inhabiting population from that on Jeju Island.

Conclusion

Based on the above evidence, we confirm that *Isometopus jejuensis* Kim & Jung, 2016 is a new subjective synonym of *Isometopus amurensis* Kerzhner, 1988. Accordingly, Korean Jeju Island is added to the distribution of *I. amurensis*, marking it the southernmost distribution record for the species (Fig. 5).

Figure 5. Distribution of *Isometopus amurensis* Kerzhner, 1988 in East Asia. Two localities in Jeju Island refer to records previously reported for *I. jejuensis* Kim & Jung, 2016

Figure 6. *Isometopus amurensis* Kerzhner, 1988, live specimens. **A, B.** Male; **C, D.** Female, **E.** Early-stage nymph; **F, G.** Final instar nymph.

Biology

In the western lowlands of South Korea (cf. Incheon, Siheung, Anyang, Gwacheon) adults appear in mid-June and mid-August, suggesting that this species has at least two generations per year. Immatures of various developmental stages were observed on the bark of *Acer palmatum* Thunb. (Sapindaceae), *Betula pendula* subsp. *mandshurica* (Regel) Ashburner & McAll. (Betulaceae), *Albizia julibrissin* Durazz. (Fabaceae), *Prunus × yedoensis* Matsum. (Rosaceae), *Salix* sp. (Salicaceae), *Styphnolobium japonicum* (L.) Schott (Fabaceae), *Styrax japonicus* Siebold & Zucc. (Styracaceae), *Quercus palustris* Münchh. (Fagaceae),

and *Zelkova serrata* (Thunb.) Makino (Ulmaceae). Kerzhner (1988b) reported specimens collected at light from Primorsky Krai, Russia. Similarly, we collected a single male at an artificial light in Gwacheon, Korea.

Observed adults and nymphs actively moved along the bark surface and probed between the bark and mosses with their labium, likely searching for prey (Suppl. material 1). Multiple bark lice, small spiders, mites, and springtails were found on the bark along with *I. amurensis* and were assumed to be the possible prey items (Yasunaga 2005; Tsunoda et al. 2020). Other congeners, including *I. citri* Ren, 1987, *I. japonicus* Hasegawa, 1946, *I. rugiceps* Kerzhner, 1988 and *Myiomma ussuriense* Ostapenko, 2001 were often found on the same bark with *I. amurensis*. In a suburban park in Gwacheon-si, this species was found co-inhabiting the bark of *Z. serrata* with two hallodapine species, *Acrorrhinium inexpectatum* (Josifov, 1978) and *Cleotomiris josifovi* Konstantinov & Simov, 2014 (Phylinae: Hallodapini); these species possibly share and compete for prey.

Notes on Korean species of the subfamily Isometopinae (Hemiptera: Miridae)

Isometopus citri Ren, 1987

Fig. 7J–K

Isometopus citri Ren, 1987: 398. Holotype: (♀), China: Xixiang, Shaanxi; NKUM.

Isometopus citri: Zheng 1995: 460 (list), Kerzhner and Josifov 1999: 3 (catalogue, distribution), Schuh, 2002–2013 (web catalogue), Qi 2005: 511 (listed, distribution, host plant), Liu et al. 2022: 429 (redescription, distribution, host plant), Taszakowski et al. 2023: 185 (catalogue).

Material examined. South Korea – **Gyeonggi-do.** • 2 ♀♀; Ilsan lake park, Goyang-si; 37°39.17'N, 126°45.85'E; 20.vi.2024; W. Kim leg. (SNU, UMMZ) – **Jeollanam-do.** • 1 ♀; 124, Byekgye-ro, Okryong-myeon, Gwangyang-si; 10.vi.2025; M. Oh leg. (SNU).

Distribution. China (Fujian, Shaanxi, Yunnan) (Liu et al. 2022), South Korea (Gyeonggi-do, Jeollanam-do).

Note. This is a new record for Korea. Two females were collected from the bark of *Prunus × yedoensis* planted for ornamental purposes, where they were found with *I. amurensis* and *I. japonicus*. Another female from Gwangyang was collected from the bark of *Z. serrata*.

Isometopus japonicus Hasegawa, 1946

Fig. 7A–E

Isometopus japonicus Hasegawa, 1946: 1. Holotype: (♂), Japan: Ōiso, Prov. Sagami, Honshu; NIAES.

Isometopus japonicus: Eyles 1971: 942 (list), Kerzhner and Josifov 1999: 4 (catalogue, distribution), Yasunaga 2001: 16, 118 (diagnosis, photo, host plant), Yasunaga and Hayashi 2002: 100 (checklist, distribution), Schuh 2002–2013 (web catalogue), Kim and Jung 2016: 140 (redescription), Ahn et al. 2018: 380 (diagnosis, photo); Urayama et al. 2019: 79 (distribution, photo), KSAE and ESK 2021: 155 (list), Taszakowski et al. 2023: 185 (catalogue).

Figure 7. *Isometopus* species in South Korea. **A–E.** *Isometopus japonicus* Hasegawa, 1946. **A.** Habitat, on bark of *Zelkova serrata*; **B.** Early-stage nymph; **C.** Male; **D.** Final instar; **E.** Female; **F–H.** *I. rugiceps* Kerzhner, 1988. **F.** Habitat, on bark of *Albizia julibrissin*; **G.** Final instar; **H.** Female; **I–K.** *I. citri* Ren, 1987. **I.** Habitat, on bark of *Prunus × yedoensis*. **J, K.** Female.

Material examined. SOUTH KOREA – **Seoul.** • 2 nymphs; Umyeon-dong, Seocho-gu; 37°27.97'N, 127°01.19'E; 22.v.2024; W. Kim leg. (SCNU). – **Gyeonggi-do.** • 3 ♀♀; Jungang-dong, Gwacheon-si; 37°25.52'N, 126°59.27'E; 17.vi.2023; W. Kim leg. (SCNU) • 6 nymphs (4th and 5th); same locality; 21.v.2024; W. Kim leg. (SCNU) • 1 nymph (5th); same locality and collector; 29.v.2024 (UMMZ) • 1 nymph (4th);

Galhyeon-dong, Gwacheon-si; 37°25.25'N, 126°58.25'E; 21.v.2024; W. Kim leg. (UMMZ) • 5 ♂♂, 10 nymphs (4th and 5th); Neunggok-dong, Siheung-si; 37°21.92'N, 126°48.83'E; 24.v.2024; W. Kim and J. Park leg. (SCNU) • 1 ♀; same locality; 28.vi.2024; W. Kim leg. (SCNU); • 1 ♀; Ilsan lake park, Goyang-si; 37°39.17'N, 126°45.85'E; 20.vi.2024; W. Kim leg. (SCNU).

Distribution. Japan (Hokkaido, Honshu, Shikoku, Kyushu, Tsushima Island) (Yasunaga and Hayashi 2002), South Korea (Gyeonggi-do, Chungcheong-buk-do, Jeollabuk-do) (Ahn et al. 2018).

Note. This species was described based on 40 specimens from eight localities in Honshu and Hokkaido in Japan, and was reported from various parts of temperate Japan until Kim and Jung (2016) reported it from South Korea based on seven males and five females, all from the single locality in Jeonju-si, Jeollabuk-do Province. The original description of Hasegawa (1946) mentioned the coloration of the hemelytra as 'brownish ochraceous or blackish brown, base of the corium and embolium with a pale flavescent (or whitish) triangular patch...' and subsequent studies including (Yasunaga 2001: pl. 2; fig. 5B, C) also depict similar characteristics. However, the Korean specimens reported by Kim and Jung (2016) does not have a conspicuous pale brown region on the base of corium (Kim and Jung 2016: 138, fig. 1C), which differs from their description of females that have the 'hemelytra mostly dark brown; base of corium and embolium pale brown' (Kim and Jung 2016: 142). Multiple specimens collected by the authors in various localities in Korea also have a uniformly dark brown hemelytra in females (Fig. 7E). Whether this color forms represent geographic variation could be resolved by future reexamination and comparative study of Korean and Japanese specimens.

We note that the live habitus photo provided by Ahn et al. (2018) has the male and female labels reversed. Kim and Jung (2016: 144) indicated that *Zelkova serrata* was a new host record for *I. japonicus*, but this is clearly an error since earlier Japanese literature mentioned this species from various deciduous trees, including *Z. serrata* (Yasunaga 2001: 118, also see Table 3).

In Korea, this species is commonly found but not restricted to the bark of *Z. serrata* (Table 3). Early stage nymphs (2nd–3rd) were observed in Pocheon-si, Gyeonggi-do (J. Park, pers. comm., April 2024) on 21 April 2024. The first author also observed a freshly emerged male on 24 May 2024 in Siheung-si. Based on the collection records, this species seems to have a univoltine lifecycle, where adults appear from late May to June in the central regions of the Korean Peninsula.

Isometopus rugiceps Kerzhner, 1988

Fig. 7F–H

Isometopus rugiceps Kerzhner, 1988a: 789. Lectotype (as holotype, see Kerzhner 1988b: 6): ♂, Russia: Vityaz', 15 km south of Sukhanovka; ZISP.
Isometopus rugiceps: Kerzhner and Josifov 1999: 5 (catalogue, distribution), Schuh 2002–2013 (web catalogue), Ahn et al. 2018: 382 (diagnosis, photo), KSAE and ESK 2021: 155 (list), Taszakowski et al. 2023: 186 (catalogue).

Material examined. South Korea – **Gyeonggi-do.** • 1 nymph (5th); Jungang-dong, Gwacheon-si; 37°25.54'N, 126°59.28'E; 21.v.2024; emerged as ♀ on 24.v.2024; W. Kim leg. (SCNU) • 1 ♀, 5 nymphs (5th); Manan-gu, Anyang-si; 37°25.96'N,

126°54.92'E; 24.v.2024; W. Kim and J. Park leg. (SCNU) • 1 ♂; same locality; 25.v.2024; J. Park leg. • 3 ♀♀; same locality; 30.v.2024; W. Kim leg. (SCNU). – **Gangwon-do.** • 1 ♀; Jindong-ri, Girin-myeon, Inje-gun; 576 m alt.; 13.vii.2016; Oh, Lee, Choi, Ahn leg. (SNU) • 4 ♀♀; Anheung-myeon, Hoengseong-gun; 37°27.79'N, 128°08.44'E; 18.vi.2023; W. Kim leg. (SCNU, UMMZ). – **Gyeongsangnam-do.** • 8 ♀♀; Sicheon-myeon, Sancheong-gun; 35°14.06'N, 127°47.37'E; 13.vi.2024; on light; W. Kim and S. Yang leg. (SCNU, UMMZ).

Distribution. Russia (Far East: Primorsky Krai) (Kerzhner 1988b), South Korea (Gyeonggi-do, Gangwon-do, Gyeongsangnam-do, Jeollabuk-do) (Ahn et al. 2018).

Note. This species is widely distributed in South Korea, where it inhabits the bark of multiple deciduous tree species (Table 3). Kerzhner (1988b) briefly mentioned three nymphs that might pertain to this species collected from Ryazanovka, Primorsky Krai, on the bark of *Quercus* sp. (Fagaceae) and *Ulmus* sp. (Ulmaceae), but no additional information is available. We present images of the final-instar nymphs for the first time (Fig. 6F); at first glance, it resembles *I. hananoi* Hasegawa, 1946 from temperate Japan in having a dark dorsum scattered with small, whitish spots (Tsunoda et al. 2020), but they can be distinguished by the spots being smaller and sparser, and the dark brown tergal segments with a medial bright region, its width approximately 1/4 of each abdominal segment.

Kerzhner (1988b) reported individuals collected at light in two localities from Primorsky Krai. Similarly, we collected eight females at a light trap in Sancheong-gun, Gyeongsangnam-do Province. Additionally, a single male was collected at light in Mt. Maisan, Jeollabuk-do Province (WG Kim, *pers. comm.*).

Tribe Myiommini Bergroth, 1924
Genus *Myiomma* Puton, 1872

Myiomma ussuriense Ostapenko, 2001
Fig. 8A–F

Myiomma ussuriensis: Ostapenko, 2001: 358. Holotype: ♀, Russia: 30 km NW of Arsen'ev, Primorsk Terr.; originally in Ostapenko's collection, now deposited at ZISP.
Myiomma ussuriensis: Schuh, 2002–2013 (web catalogue), Taszakowski et al. (2023): 190 (catalogue).
Myiomma ussuriense: Kment and Carapezza 2017: 566 (list).
Myiomma koreana: Oh et al. 2025: 147. Holotype: ♂, Korea: Mt. Gaya, Seongju-gun; SNU. syn. nov.
Myiomma kukai: Jung and Lee 2012: 53 (misidentification), see Oh et al. 2025: 152.

Type material examined. ***Myiomma ussuriense*** **Ostapenko, 2001.** ***Holotype*****:** ♀, "[Primorsky krai, 30 km \ NW of Arsen'ev \ on *Fraxinus mandshurica* \ K. Ostapenko, 4.8.1999]" [handwritten] "*Holotypus* \ Myiomma \ ussuriensis \ Ostapenko det. 2000" [printed + handwritten] also with ZISP catalogue number: INS_HEM_0000126; deposited in ZISP. ***Myiomma koreanum*** **Oh & Lee, 2025.** ***Holotype*****:** ♂, "SNU \ Coll.#: 220806 MS-001 \ Loc.: Mt. Gaya, \ Seongju-gun, GB, Korea \ from light trap \ Date: 06.viii.2022 \ Leg.: WG. Kim" [printed] "HOLOTYPE \ *Myiomma koreana* \ Oh & Lee, 2025" [printed]; deposited in SNU.

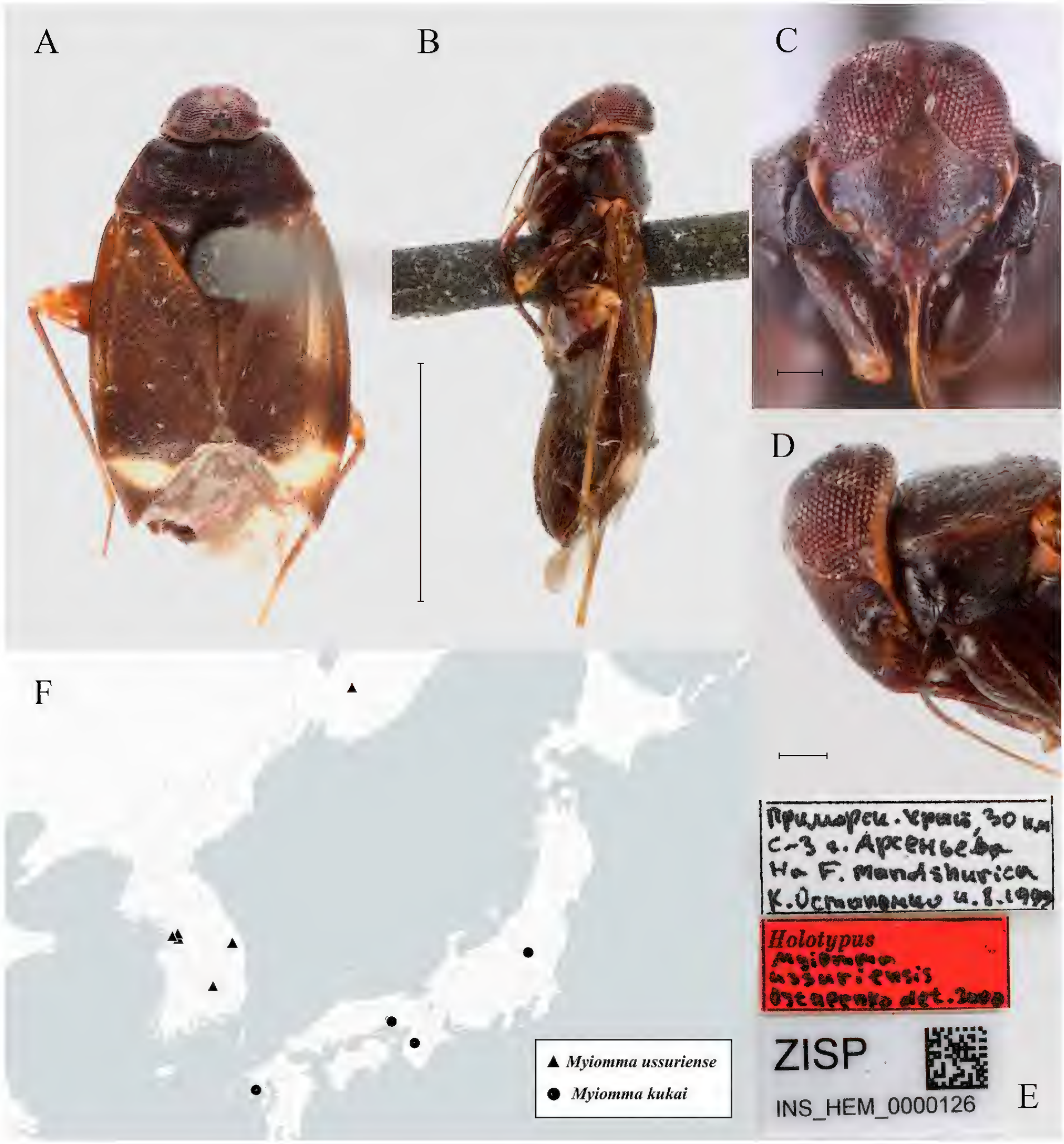

Figure 8. *Myiomma ussuriense* Ostapenko, 2001, holotype. **A.** Dorsal view; **B.** Lateral view; **C.** Head in frontal view; **D.** Head in lateral view; **E.** Labels; **F.** Distribution of *M. ussuriense* and *M. kukai* in East Asia. Scale bars: 1.0 mm (**A, B**); 0.1 mm (**C, D**). © ZISP (**A–E**).

Note. Oh et al. (2025) described *M. koreana* based on eight specimens collected from four localities in South Korea, provided a description of both sexes, and briefly documented its bionomics. However, according to Kment and Carapezza (2017) the correct gender of *Myiomma* is neuter, and this species name should be amended as *M. koreanum* (ICZN 1999, article 31.2.). In describing *M. koreanum*, the authors were aware of *M. ussurense*, which has been described based on a single female from Primorsky Krai, Russia, but have regarded the Korean specimens as distinct, mostly following Ostapenko's (2001) original description of *M. ussuriense*.

Type specimens of *M. koreanum* collected from Korea showed differences with Ostapenko's (2001) descriptions and figures, mainly following color and structures (original text of Ostapenko 2001: 358 in square brackets): 1) Structure of postocular rim viewed from the lateral side, 2) Inner margin of compound eye not conjoined [Eyes large, contacting along midline of head], 3) Blackish brown metafemur [hind femora pale brown, with diffuse subapical ring and apex yellow], 4) Dorsum densely covered with brown setae [covered dorsally with sparse recumbent hairs], 5) Clavus and corium uniformly dark brown [Inner margin of clavus and base of corium yellowish brown], 6) Metatibia widely dark brown, apical 1/4 pale [hind tibiae dark brown with yellowish apical half].

Photographic examination of the holotype of *M. ussuriense* housed at ZISP (Fig. 8A–E) showed that Ostapenko's (2001) description is misleading, as it is different from the actual conditions found in the holotype. All morphological features of the female specimens of *M. koreanum* collected from Korea match well with the holotype of *M. ussuriense*, and we confirm that *Myiomma koreanum* Oh & Lee, 2025 is a new subjective synonym of *Myiomma ussuriense* Ostapenko, 2001.

Therefore, COI sequences previously submitted to GenBank, PQ530509, PQ530510 (Oh et al. 2025, as *M. koreana*) and GU194800 (Jung and Lee 2012, as *M. kukai*. See Oh et al. 2025: 151, 152) should be referred to as *M. ussuriense*. Kerzhner (1988b) mentioned a nymph of an undescribed *Myiomma* collected from Ryazanovka, Primorsky Krai, on the bark of *Quercus dentata*, but this species was never formally described, and could possibly pertain to *M. ussuriense*, based on the distribution of known *Myiomma* species from the Far East (Fig. 8F).

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Use of AI

No use of AI was reported.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

Feeding attempts of *Isometopus* species in the natural habitat

Authors: Wonwoong Kim

Data type: mov

Explanation note: 1, *Isometopus japonicus*, early-stage nymph; 2, same, final instar nymph; 3, *I. amurensis*, final instar nymph; 4. *I. rugiceps*, adult female.

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